

be brought in contact with the gold ball of the capillary 93 as shown in Fig. 47C, a bump 103 as shown in Fig. 47B is formed on the electrode 2 of the IC chip 1 by supersonic wave thermocompression-bonding by means of a capillary 193 whose tip shape has a tip portion 193a provided with no flat portion in the portion to be brought in contact with the gold ball 96a of the capillary 193 as shown in Fig. 47A. By using the capillary 193 having the above-mentioned tip shape, an approximately conically tipped bump 103 as shown in Fig. 47B can be formed on the electrode 2 of the IC chip 1. Even when the approximately conically tipped bump 103 formed by the above-mentioned method is mounted on the electrode 5 of the circuit board 4 while being shifted as shown in Fig. 48C, the bump 103 can be partially brought in contact with the electrode 5 of the board 4 without fail since the bump 103 has the approximately conically shaped tip so long as the shift is not greater than half the outside diameter of the bump 103.

In contrast to this, in the case of a bump 3 as shown in Fig. 48D, when the bumps 3 are mounted on the electrodes 5 of the circuit board 4 while being shifted by a dimension Z as shown in Fig. 48C, the so-called base 3g of a width dimension d partially comes in contact with the electrode 5 as shown in Fig. 48E. However, this contact is mere partial contact, leading to bonding in an unstable

contact state. If the board 4 is subjected to a thermal shock test or reflow in the above unstable bonding state, then the bonding in the unstable bonding state may result in becoming open, that is, defective bonding. In contrast to this, according to the twenty-first embodiment, even when the approximately conically tipped bump 103 is mounted on the electrode 5 of the circuit board 4 while being shifted by the dimension Z as shown in Fig. 48C, the bump 103 can partially come in contact with the electrode 5 of the board 4 without fail so long as the shift is not greater than half the outside diameter of the bump 103 since the bump 103 has the conical tip shape, and this can prevent the possible occurrence of the defective bonding even when the board is subjected to the thermal shock test or reflow.

(Twenty-Second Embodiment)

A method and apparatus for mounting an electronic component of, for example, an IC chip on a circuit board and an electronic component unit or module of, for example, a semiconductor device in which the IC chip is mounted on the board by the mounting method, according to a twenty-second embodiment of the present invention will be described next with reference to Fig. 49 and Fig. 50. According to this twenty-second embodiment, the stress of the IC chip 1 and the circuit board 4 in the sixteenth

embodiment can be alleviated when the thermosetting resin is hardened after the bonding of the IC chip 1 to the circuit board 4.

In the twenty-second embodiment, the bumps 3 formed on the electrodes 2 of the IC chip 1 by the wire bonding are aligned in position with the electrodes 5 of the circuit board 4 without leveling the bumps with interposition of a solid or semi-solid thermosetting resin sheet 6 or the thermosetting adhesive 306b obtained by mixing an insulating resin 306m with an inorganic filler 6f. The IC chip 1 is pressed against the circuit board 4 with a pressure force P1 of not smaller than 80 gf per bump in the case of a ceramic board while heating the IC chip 1 from its rear surface side by the tool 8 heated to a specified temperature of, for example, 230°C to correct the warp of the board 4, and the thermosetting resin sheet 6 or the thermosetting adhesive 306b interposed between the IC chip 1 and the circuit board 4 is hardened by the heat. Next, assuming that the total time is, for example, 20 seconds, then, after a lapse of a specified time t1, i.e., after a lapse of five to 10 seconds being one-fourth or one-half the time, also depending on the reaction rate of the material, or in other words, before the reaction rate of the material reaches 90%, the pressure is reduced to a pressure P2 lower than the pressure P1 to alleviate the